



## CASE REPORT

# Complex head-splitting fracture—dislocation of the proximal humerus successfully treated with minimal internal fixation: A case report and discussion

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## Introduction

Comminuted fractures of the proximal humeral shaft with head-splitting extension in young patients are exceptionally rare. We present a case of a high-energy compound comminuted head-splitting anterior fracture—dislocation of the proximal humerus with considerable bone loss in a teenager, which was treated by minimal internal fixation. This illustrated a successful method of management with preservation of the humeral head and considerable capacity for bone regeneration to occur in the humeral shaft. To our knowledge, this injury has not previously been reported.

## Case history

A 17-year-old man was admitted following a high-speed road traffic accident. He sustained severe injuries to the right upper limb, which consisted of a compound comminuted fracture of the proximal

third of the humeral shaft with complete head-splitting extension of the fracture line (Fig. 1) and a large overlying contaminated wound with an associated large area of skin loss, Gustilo-Anderson grade 3B.<sup>3</sup> There was no neurovascular deficit distally. He underwent a CT scan, which showed a highly comminuted fracture over 12–14 cm of the proximal humeral shaft extending to a coronal fracture of the humeral head. The anterior half of the humeral head was dislocated and sitting anterior to the glenoid, the posterior portion remained in contact with the glenoid fossa with a comminuted fracture through the neck (Fig. 2A and B). This comminution extended throughout the proximal third of the humeral shaft.

At surgery thorough debridement was carried out and the proximal third of the humeral shaft was found to be highly comminuted with marked degloving and soft tissue stripping of multiple fragments in this segment. These fragments were loose and devitalised and were therefore removed, leaving only ~50% of the diameter of diaphyseal bone remaining, which still had an intact soft tissue attachment. This half-diameter column of bone extended over approximately 10–12 cm and was unsuitable for internal fixation or application of a bridging plate.

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Figure 1

Through a delto-pectoral approach and extension of the traumatic wound, the dislocated fragment was reduced, and the head was fixed with two fully threaded AO cancellous screws. No additional fixation was used. Primary soft tissue closure was achieved by loosely approximated muscle and a meshed split skin graft. The arm was placed in a hanging cast for 3 weeks followed by a Mastersling for a further 3 weeks. Shoulder physiotherapy and mobilisation were commenced 6 weeks from the injury and the humerus was protected in a humeral brace for a further 6 weeks. Thereafter, the arm was left free of any support.

Soft tissue and bony healing occurred without further surgical intervention. The humeral head fracture united with no evidence of avascular necrosis, confirmed radiologically by a normal three-

phase isotope bone scan (technetium-99). The humeral shaft fracture united fully both clinically and radiologically within 3 months without the need for further surgery or bone grafting (Fig. 3A and B). He recovered shoulder abduction and flexion  $>130^\circ$ , and full elbow and wrist function on the injured side within 8 months of injury.

## Discussion

Proximal humeral fractures are common in the elderly but much less common in younger patients.<sup>5,7</sup> Head-splitting fractures of the humerus with subluxation or dislocation may occur in the young but they are rare and difficult to treat, with relatively few cases reported in the literature.<sup>1,4</sup> There is insufficient data in the current literature for evidence-based decision-making with regards to the treatment of complex proximal humeral fractures.<sup>6</sup> Head-splitting fractures occur as a result of violent compression of the head against the glenoid;<sup>2</sup> the head splits and the tuberosities may remain attached to the fragments, or split and separate. Displacement leads to subluxation or dislocation of one of the fragments whilst the other remains in contact with the glenoid. Computed tomography provides excellent visualisation of the relation of the glenoid and the humeral head, and better demonstration of fracture fragments than plain X-rays alone.<sup>11</sup> Shoulder hemiarthroplasty has been advocated as a treatment for complex displaced intra-articular fractures of the humeral head due to the risk of subsequent avascular necrosis.<sup>9</sup> However, in younger patients, head-preserving

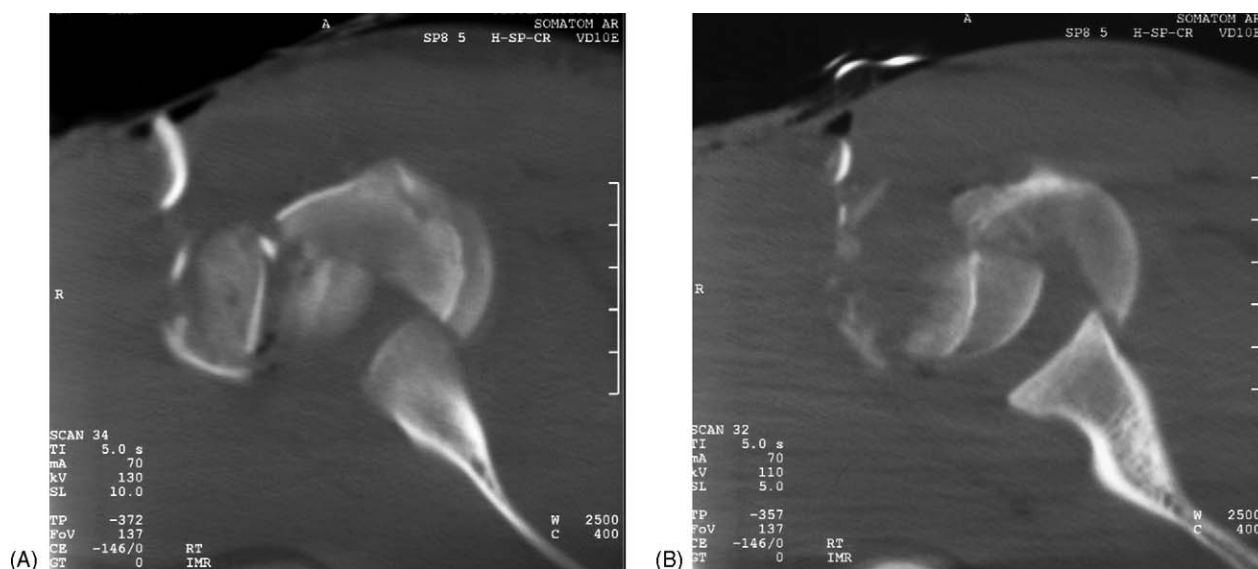


Figure 2

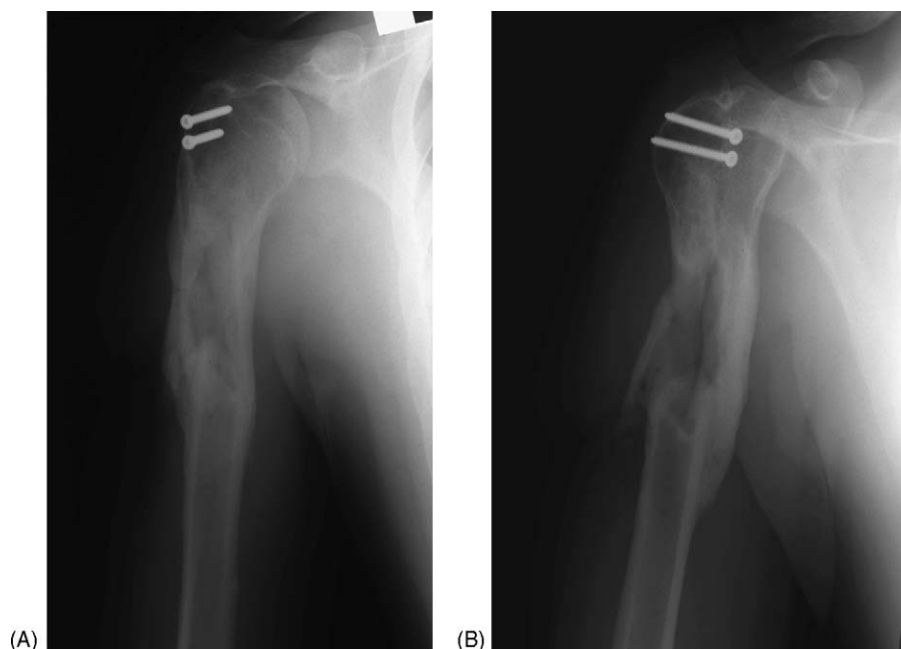


Figure 3

methods of treatment are more appropriate.<sup>10</sup> This should be achieved with minimal internal fixation where possible.<sup>8</sup>

In this case, the injury pattern resulted from a direct lateral impact at high velocity to the proximal humerus. CT scan enabled surgical planning and is recommended if a head-preserving surgical approach is being considered. The humeral head fracture was reduced and fixed within 6 h of injury using a technique of minimal osteosynthesis; it is likely that timing to surgery, the use of a minimal fixation technique and minimal tissue handling without disruption to local blood supply have all significantly reduced the potential risk of AVN. Judicious surgical technique in debridement of all necrotic tissue including devitalised bone with preservation of remaining soft tissue attachments is important in the humeral shaft as well, leading to improved local conditions for healing to occur in the diaphyseal segment of this fracture despite the extensive bone loss and without the need for secondary bone graft. Subsequent remodelling was enhanced by early mobilisation.<sup>12</sup>

## Conclusion

The primary aim of the trauma surgeon in treating a head-splitting fracture—dislocation of the proximal humerus in the young patient is preservation of the humeral head. This case demonstrates the value of CT scan in surgical planning and the role of minimal

internal fixation in treatment of humeral head-splitting fractures and achieving preservation of the head. It also demonstrates the remarkable capacity of the proximal humeral shaft to regenerate and heal, despite substantial bone loss, provided initial debridement has been adequate.

## References

1. Chesser TJS, Langdon IJ, Ogilvie C, Sarangi PP, Clarke AM. Fractures involving splitting of the humeral head. *J Bone Joint Surg [Br]* 2001;83-B:423–6.
2. Fisher RA, Nicholson GP, McIlveen SJ, et al. Primary humeral head replacement for severely displaced proximal humerus fractures. In: Presented at American Academy of Orthopaedic Surgeons, 59th Annual Meeting; 1992.
3. Gustilo RB, Anderson JT. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: retrospective and prospective analyses. *J Bone Joint Surg [Am]* 1976;58(4):453–8.
4. Ko JY, Yamamoto R. Surgical treatment of complex fracture of the proximal humerus. *Clin Orthop* 1996;327:225–37.
5. Lind T, Kroner TK, Jensen J. The epidemiology of fractures of the proximal humerus. *Arch Orthop Trauma Surg* 1989;108:285–7.
6. Misra A, Kapur R, Maffulli N. Complex proximal humeral fractures in adults—a systematic review of management. *Injury* 2001;32(5):363–72.
7. Neer CS. II Displaced proximal humeral fractures. Part 1: Classification and evaluation. *J Bone Joint Surg [Am]* 1970;52A:1077–89.
8. Resch H, Hubner C, Schwaiger R. Minimally invasive reduction and osteosynthesis of articular fractures of the humeral head. *Injury* 2001;32(Suppl. 1):SA25–32.

9. Self EB, Bigliani LU. Four-part and head-splitting fractures of the proximal humerus: treatment with prosthetic replacement. In: Flatow EL, Ulrich C, editors. *Humerus-Musculoskeletal Trauma Series*. Butterworth Heinemann; 1996. p. 57–69.
10. Sperling JW, Cofield RH, Rowland CM. Neer hemiarthroplasty and Neer total shoulder arthroplasty in patients fifty years old or less: long term results. *J Bone Joint Surg [Am]* 1998;80-A:464–7.
11. Wadlington VR, Hendrix RW, Rogers LF. Computed tomography of posterior fracture–dislocations of the shoulder: case reports. *J Trauma* 1992;32:113–5.
12. Wolff J. *Das gesetz der transformation der knochen*. Berlin: Hirschwald, 1992.